

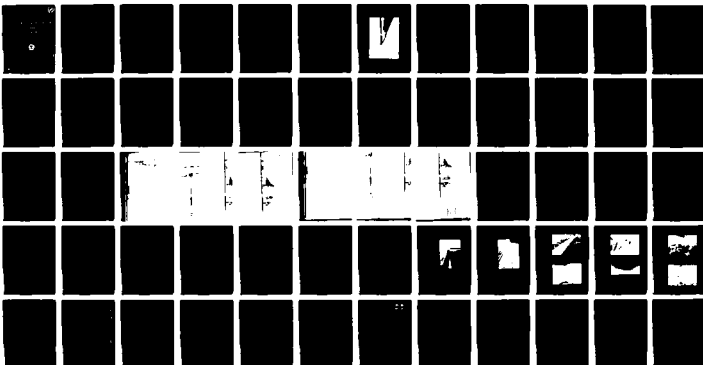
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NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/6 13/13
NATIONAL DAM SAFETY PROGRAM, POTTERSVILLE RESERVOIR DAM (NJ 007--ETC(U)
MAY 81 J SIRIANNI, J TALERICO DACW61-79-C-0011

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RARITAN RIVER BASIN
UPPER COLD BROOK,
HUNTERDON COUNTY
NEW JERSEY

POTTERSVILLE RESERVOIR DAM

NJ 00783

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO.: DAEN/NAP-53842/NJ 00783-81/05

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This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE-2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

28 AUG 1961

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Department of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Dear Mr. O'Dowd:

We are forwarding, for your information, under separate cover the available copies of the Final Report for Pottersville Reservoir Dam, NJ00783. Since the dam does not meet the size criteria for inclusion in the National Inventory of Dams, a Corps of Engineers Assessment has not been prepared. The report does, however, provide a valid indication of the condition of the dam.

Sincerely,

1 Incl (14 cys)
As stated fwd sep

D. J. SHERIDAN
Chief, Planning/Engineering Division

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RARITAN RIVER BASIN
UPPER COLD BROOK, HUNTERDON COUNTY
NEW JERSEY

POTTERSVILLE RESERVOIR DAM

NJ00783

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA 19106

MAY, 1981

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name: Pottersville Reservoir Dam, I.D. NJ 00783
State Located: New Jersey
County Located: Hunterdon County
Stream: Upper Cold Brook
River Basin: Raritan River
Date of Inspection: January 9 and February 3, 1981

Assessment of General Conditions

Pottersville Reservoir Dam is a rubble masonry gravity dam with a broad crested notched weir in the center. The overall condition of the dam is fair. There are no major signs of distress or instability in the dam. Minor seepage was observed in downstream face of the right wingwall just right of the spillway. A section of the masonry facing on the downstream slope of the left wingwall has sloughed off. The hazard potential is recommended to be downgraded to "significant".

Pottersville Reservoir Dam is considered inadequate in view of its lack of spillway capacity to pass the SDF (1/2 PMF) without overtopping the dam. The spillway is capable of passing a flood equal to 8 percent of the PMF (16 percent of the 1/2 PMF), and is assessed as "inadequate".

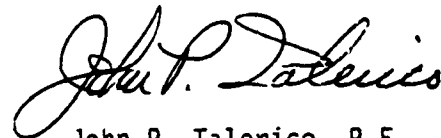
At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory. The following actions are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. Repair cracks in concrete capping on crest of left and right wingwalls and replace missing concrete facing on upstream face of both walls within twelve months.
3. Repair and replace missing masonry facing on downstream face of left wingwall. This should be done within twelve months.

4. Remove all vegetation growing from the joints and repoint them if necessary. This should be started within twelve months.
5. Determine if the low-level outlet is operable and if not institute remedial action to make it operable within twelve months.
6. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.

Furthermore, while of a less urgent nature, the following additional actions are recommended and should be carried out within twelve months.

1. Conduct a complete topographic survey of the dam and surrounding area in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings to form a coherent as-built set.
2. The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.



John P. Talerico, P.E.
HARRIS-ECI ASSOCIATES



Photo taken February 3, 1981

POTTERSVILLE RESERVOIR DAM

View of dam looking towards the right end.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

POTTERSVILLE RESERVOIR DAM, I.D. NJ 00783

SECTION 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates of Woodbridge, New Jersey.

b. Purpose of Inspection

The visual inspection of Pottersville Reservoir Dam was made on January 9, and February 3, 1981. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Pottersville Reservoir Dam is a rubble masonry gravity dam with a concrete core. It has a height of 20.8 feet and an overall length of approximately 180 feet. The dam is comprised of three sections: a wingwall on the left and on the right; and a 50 foot spillway in the center. The spillway is a broad crested weir with a 20 foot wide notch, three inches deep, in the center. The crest of the notch is 3.0 feet below the top of the wingwalls. The slope of the upstream face is nearly vertical while the downstream face is vertical to the spillway crest elevation and then slopes at approximately 1H:1.6V.

The low-level outlet consists of two 16-inch cast iron pipes through the spillway. The first pipe is approximately 5 feet left of the centerline of the spillway. The flow through this pipe is regulated by a manually operated gate valve located on the left side of the spillway at the upstream face. The second pipe is located 15 feet to the right of the centerline of the spillway. The valve for this pipe could not be located. The outlets for both pipes are approximately 6 feet above water level of Upper Cold Brook into which they discharge. From there the flow continues downstream where it passes under the access road to the dam through a 16 foot by 6 foot opening approximately 270 feet from the dam.

An intake structure for a chlorination building is located on the upstream face 11 feet left of the spillway. The intake is a 13 foot long by 5.5 foot wide masonry structure with two manually operated 8-inch valves which control the flow. It is connected to the chlorination building, which is 110 feet downstream, by an 8-inch cast iron pipe. An 8-inch cast iron pipe was also found at the toe of slope along the left wingwall and is assumed to be a drain for the embankment.

A generalized description of soil conditions is contained in Report No. 6, Hunterdon County, Engineering Soil Survey of New Jersey, by Rutgers University. The report dated 1952 describes the Hunterdon County section as silts, silty clays and silty sands. The underlying formation is Gneiss of variable depth due to variably sloping hills. The Hunterdon County map describes its section as Gneiss rock. Geologic Overlay Sheet 22 further describes the rock as Hyperstene-Quartz-Andesine Gneiss.

b. Location

Pottersville Reservoir Dam is located on Upper Cold Brook in the Township of Tewksbury, Hunterdon County, New Jersey. It is accessible from Pottersville by way of Fairmont Road East(Route 512) to Hollow Brook Road.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineers, the dam is classified in the dam size category as being "small", since its storage volume of 23 acre-feet is less than 1,000 acre feet. The dam is also classified as "small" because its height of 20.8 feet is less than 40 feet. The overall size classification of Pottersville Reservoir Dam is "small".

d. Hazard Classification

A hazard potential classification of "significant" has been assigned to the dam on the basis of the following facts; the reservoir is part of a water supply system; the chlorination building is immediately downstream of the dam and is visited daily by water company personnel. Therefore a hypothetical failure of the dam would affect the water supply system and result in excessive damage to chlorination building and equipment.

e. Ownership

Pottersville Reservoir Dam is owned by:

Elizabethtown Water Co.
1 Elizabethtown Plaza
Elizabeth, NJ 07207

Attention: Mr. Thomas J. Cawley
Vice President
(201) 354-4444

f. Purpose

Pottersville Reservoir Dam is presently used as a storage reservoir for the water supply system.

g. Design - Construction History

Pottersville Reservoir Dam was constructed in 1928. On November 20, 1928, the dam was inspected by the Department of Conservation and Development. The report of this inspection stated that it was intended to dewater reservoir the following spring then plaster or gunite the upstream face and place a clay blanket at the left end of the dam. Records could not be found to verify that these repairs were carried out.

On May 23, 1968 at the request of the Bureau of Water Control the Sommerville Water Company inspected the dam. The report of this inspection stated that although the dam is structurally sound, repairs to eliminate seepage at the spillway should be carried out in the Fall of the year. Once again records verifying these repairs could not be found.

h. Normal Operating Procedures

Pottersville Reservoir Dam is primary storage reservoir for the area. The reservoir is used as a water supply all year round but especially during the summer months when the supply from wells in the area is not sufficient. The level of the reservoir is maintained through the unregulated flow over the spillway.

1.3 Pertinent Data

a. Drainage Area

2.0 sq. mi.

b. Discharge at Dam Site

Ungated spillway capacity at
elevation of top of dam:

722 cfs (485.5 NGVD)

Total spillway capacity at
maximum pool elevation (SDF):

4,461 cfs (488.83 NGVD)

c. Elevation (Feet above NGVD)

Top of dam:

485.5

Maximum pool design surcharge (SDF):

488.83

Recreation pool:

482.50

Spillway crest:

482.50

Streambed at centerline of dam:

464.7 Estimated

Maximum tailwater:

467

d. Reservoir

Length of maximum pool:

800 ft. (Estimated)

Length of recreation pool:

600 ft. (Estimated)

e. Storage (acre-feet)

Spillway Crest:

15

Top of dam:

23

Maximum pool (SDF):

35

f. Reservoir Surface (acres)

Top of dam:

3.25 (Estimated)

Maximum pool (SDF):

4.0 (Estimated)

Recreation pool:

2.5

Spillway crest:

2.5 (482.5 NGVD)

g. Dam

Type:	Rubble masonry gravity dam with concrete core.
Length:	180 ft.
Height:	20.8 ft.
Top width:	3 ft.
Side slopes - Upstream:	Vertical
- Downstream:	1H:1.35V
Zoning:	Unknown
Impervious core:	Concrete core Length unknown
Cutoff:	None
Grout curtain:	None

h. Diversion and Regulating Tunnel

8-inch C.I.P. leading to chlorination building.

i. Spillway

Type:	Broad crested notched weir.
Length of weir:	50.0 ft.
Crest elevation:	482.50
Gates:	None
U/S Channel:	Pottersville Reservoir
D/S Channel:	Natural Channel

j. Regulating Outlets

Low level outlet:	2-16-inch C.I.P.
Controls:	Manually controlled gate valve
Emergency gate:	None
Outlet:	471 NGVD Estimated

SECTION 2

2. ENGINEERING DATA

2.1 Design

Drawings for the original construction of Pottersville Reservoir Dam in 1928 are available at the Trenton offices of the NJ Department of Environmental Protection (NJ-DEP). One of these drawings shows that the dam is founded on rock except for the right end which is founded on densely packed till.

There are no known soil borings or soil tests and the only test pit data found was in two inspection report conducted by the Department of Conservation and Development on June 20 and July 16, 1928. These reports state that Gneiss rock is under the dam from the left end to the foot of the right bank. The Gneiss is seamed and jointed which may allow some seepage. Data concerning the hydraulic capacity of the spillway is unavailable.

2.2 Construction

Data is not available concerning the as-built construction of the dam. No data exists of construction methods, borrow sources, or other data pertinent to the construction of the dam.

2.3 Operation

Formal operation records are not kept for the dam and reservoir. The reservoir is allowed to operate naturally without regulation.

2.4 Evaluation

a. Availability

The availability of engineering data is poor. The stated drawings are available from the NJ Department of Environmental Protection located in Trenton.

b. Adequacy

The engineering data available, together with that obtained in the field, was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform a stability analysis, but preliminary evaluation could be made based on visual observations.

c. Validity

Information contained in the drawings and checked by limited field measurements appears to be valid. However, field investigation revealed a second low-level outlet, a 16-inch cast iron pipe, not shown on the plan, through the dam on the right side of the spillway.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Pottersville Reservoir Dam revealed the dam and spillway to be in fair condition and in need of repairs. At the time of the inspection the reservoir level was just above the crest of the normal spillway.

b. Dam

The dam is relatively sound. There is minor cracking of the concrete cap on the left and right sections of the dam. The vertical and horizontal alignment of the dam appeared good. Considerable vegetation is growing, out of the cracks on the downstream face of the left wall at the break between the vertical section and the slope and also on the slope. There is minor vegetation on the vertical section of the left wall and on both faces of the vertical section of the right wall. The concrete facing on the upstream face of the dam is missing on approximately one half of the right section and all of the left section. The grout holding the stone facing is missing on the downstream side of the left wall at the spillway. The stone facing on the downstream face in approximately the center of left wall has sloughed exposing the stone center. Minor seepage was observed in the downstream face of the right section approximately 10 feet right of the spillway.

c. Appurtenant Structures

1. Spillways

The spillway is in good condition. Minor vegetation is growing between the joints of the stone capping on both the left and right sides of the notch. Seepage under the capping was noticed on both sections of the spillway. The vertical and horizontal alignments are good.

2. Outlet Works

The outlet works consists of two 16-inch cast iron pipes controlled by stem operated valves. The pipes located on each side of the normal spillway discharge directly into the downstream channel. The controls for the right outlet pipe could not be found. In addition, there are two gate valves, attached to a concrete structure on the upstream face just left of the spillway, that control the flow to the chlorination building downstream. The concrete structure had minor spalling on the top surfaces.

d. Reservoir Area

The side slopes surrounding the reservoir are steep and wooded. There is no indication of slope instability.

e. Downstream Channel

The downstream channel is in good condition. The bottom is rocky and free from debris. The slopes are steep and wooded.

Immediately downstream on the left is the chlorination building. A timber bridge for the access road to the site crosses the channel 270 feet downstream of the dam. Approximately one mile downstream there is a new housing development located above the flood reach.

SECTION 4

4. OPERATION PROCEDURES

4.1 Procedures

Pottersville Reservoir Dam is used to impound water as a water supply for Pottersville. The level of the reservoir is maintained through the unregulated flow over the main spillway.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam. The Elizabethtown Water Company does send someone up to the dam on a daily basis to inspect and maintain the chlorination system.

4.3 Maintenance of Operating Facilities

The low-level outlet facilities consists of two manually operated gate valves. At the time of inspection, only one valve could be located, the operation of which was not demonstrated. According to the Elizabethtown Water Company, the gates have not been opened for a number of years, therefore it is not known if the gates are operational.

4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

SECTION 5

5. HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Pottersville Reservoir Dam is approximately 2.0 square miles. A drainage map of the water shed of the dam site is presented on Plate 1, Appendix D.

The topography within the basin is generally moderately sloped. Elevations range from approximately 900 feet above NGVD at the north end of the watershed to about 485 feet at the dam site. Land use patterns within watershed are mostly woodland.

The evaluation of the hydraulic and hydrologic features of the dam was based on criteria set forth in the Corps guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the Dam falls in a range of the 100-year flood to 1/2 PMF. In this case, the high end of the range, 1/2 PMF, is chosen since the factors used to select hazard classification are on the high side of their range.

The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation using Hydrometeorological Report No. 33 with standard reduction factors. Due to the small drainage area, the SCS triangular hydrograph transformed to a curvilinear hydrograph was adopted for developing the unit hydrograph, with the aid of the HEC-1-DB Flood Hydrograph Computer Program.

Initial and constant infiltration loss rates were applied to the Probable Maximum Precipitation to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the PMF and various ratios of PMF utilizing program HEC-1-DB.

The SDF peak outflow calculated for the dam is 4,461 cfs. This value is derived from the half PMF, and results in overtopping of the dam, assuming that the lake was originally at the spillway crest elevation.

The stage-outflow relation for the spillway was determined from the geometry of the spillway and dam, utilizing HEC-1 Dam Safety Version program.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1-DB program. The reservoir surface areas at various elevations were measured by planimeter from a U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based

on the assumption that the dam remains intact during routing. The spillway rating curve is presented in the Hydrologic Computation, Appendix D.

Drawdown calculations indicate that to empty the lake to an elevation of 471.7 NGVD through the one low-level outlet would take 13.8 hours, assuming a 2 cfs/square mile inflow. This is not considered to be an excessive drawdown period.

b. Experience Data

No records of reservoir stage or spillway discharges are maintained for this site.

c. Visual Observation

The downstream channel is in good condition. The slopes are steep and wooded. Immediately downstream on the left is the chlorination building and approximately one mile downstream is a new housing development.

The side slopes of the reservoir are steep with no signs of instability. The drainage area is primarily wooded and undeveloped.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 3.3 feet. Computations indicate that the dam can pass approximately 8 percent of the PMF without overtopping the dam crest. Since the 1/2 PMF is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

At the time of inspection Pottersville Reservoir Dam did not exhibit any visible signs of major distress. There was no evidence of tilting, misalignment or movement of the foundation. There are minor surface cracks on the concrete cap, with minor vegetation growing out of cracks on the upstream face near water level of the left wall. Considerable brush was growing on the break at the vertical section and on the stone facing on the slope of the left wall. There is also some minor growth on the upstream and downstream face of the right wall. The concrete facing is missing from half of the upstream face of the right wall and all of the upstream face of the left wall. Some voids were noted at the edge of the left wall at the spillway where grout holding the stones is missing. At the approximate middle of the left wall on the downstream face there is an area where the masonry facing has sloughed exposing the stone center. Minor seepage was observed about 10 feet to the right of the spillway and also under the cap stones along the spillway.

b. Design and Construction Data

No design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment.

c. Operating Records

No operating records are available relating to the stability of the dam.

d. Post-Construction Changes

There are no known post-construction changes since the dam was built in 1928.

e. Static Stability

A static stability analysis was not performed for Pottersville Reservoir Dam because the lack of data on which to base assumptions of material properties of foundation material might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist, and based on the findings of the visual inspection, the preliminary assessment of the static and seismic stabilities is that they are satisfactory.

SECTION 7

7. ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

Pottersville Reservoir Dam is inadequate because the dam does not have the spillway capacity to pass the SDF, one half of the PMF, without overtopping. Overtopping of the dam carries with it the danger of a possible failure of the dam. The present spillway capacity of the dam is approximately 8 percent of the PMF.

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment material engineering properties, but based on the findings of the visual inspection, preliminary assessment of the static stability is that is is satisfactory.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

The remedial measures and recommended actions along with a timetable for their completion are detailed below. All recommended action should be conducted under the supervision of an engineer who is experienced in the design, construction and inspection of dams.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Although Pottersville Reservoir Dam does not have the spillway capacity to pass the SDF without overtopping, remedial measures are not recommended since the dam does not meet the minimum storage requirement and a hypothetical failure would result only in property damage to the chlorination building immediately downstream.

b. Recommendations

1. The flow of seepage should be monitored monthly to determine its volume and whether it presents a problem to the safety of the dam.
2. Repair cracks in concrete capping on crest of left and right wingwalls and replace missing concrete facing on upstream face of both walls within twelve months.
3. Repair and replace missing masonry facing on downstream face of left wingwall. This should be done within twelve months.
4. Remove all vegetation growing from the joints and repoint them if necessary. This should be started within twelve months.
5. Determine if the low-level outlet is operable, and if not institute remedial measures to make it operable within twelve months.

The following additional actions are recommended:

1. The owner should develop an emergency action plan (if one is not already available) outlining actions to be taken by the operator to minimize downstream effects of an emergency and establish a flood warning system for the downstream communities within three months.
2. Conduct a complete topographic survey of the dam and surrounding area in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings and form a coherent as-built set.

c. O & M Procedures

The owner should develop, within one (1) year after formal approval of the report, written operating procedures and a periodic maintenance plan to insure the safety of the dam.

PLATES

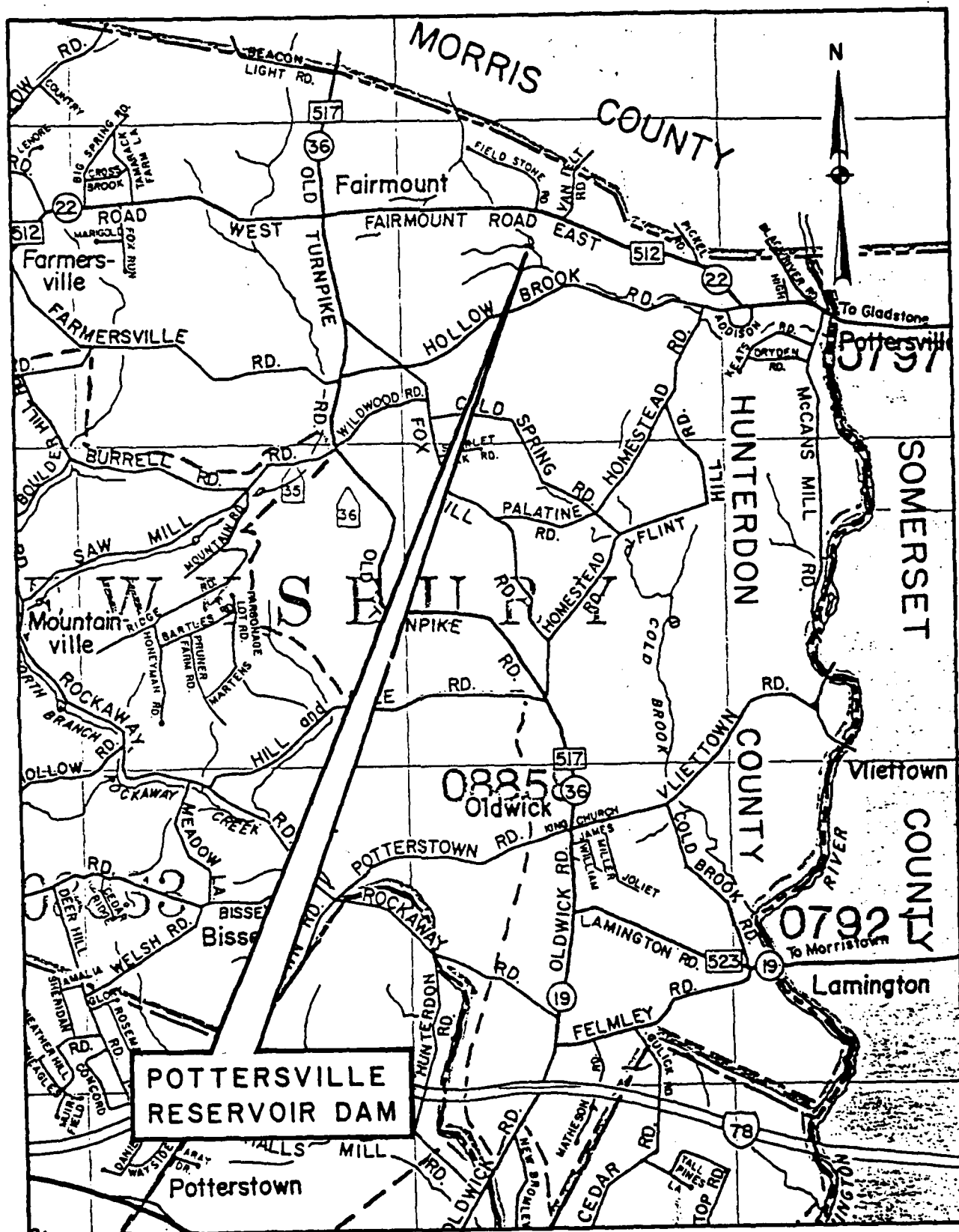
POTTERSVILLE RESERVIOR DAM

TEWKSBURY TWP.
HUNTERDON CO., N. J.

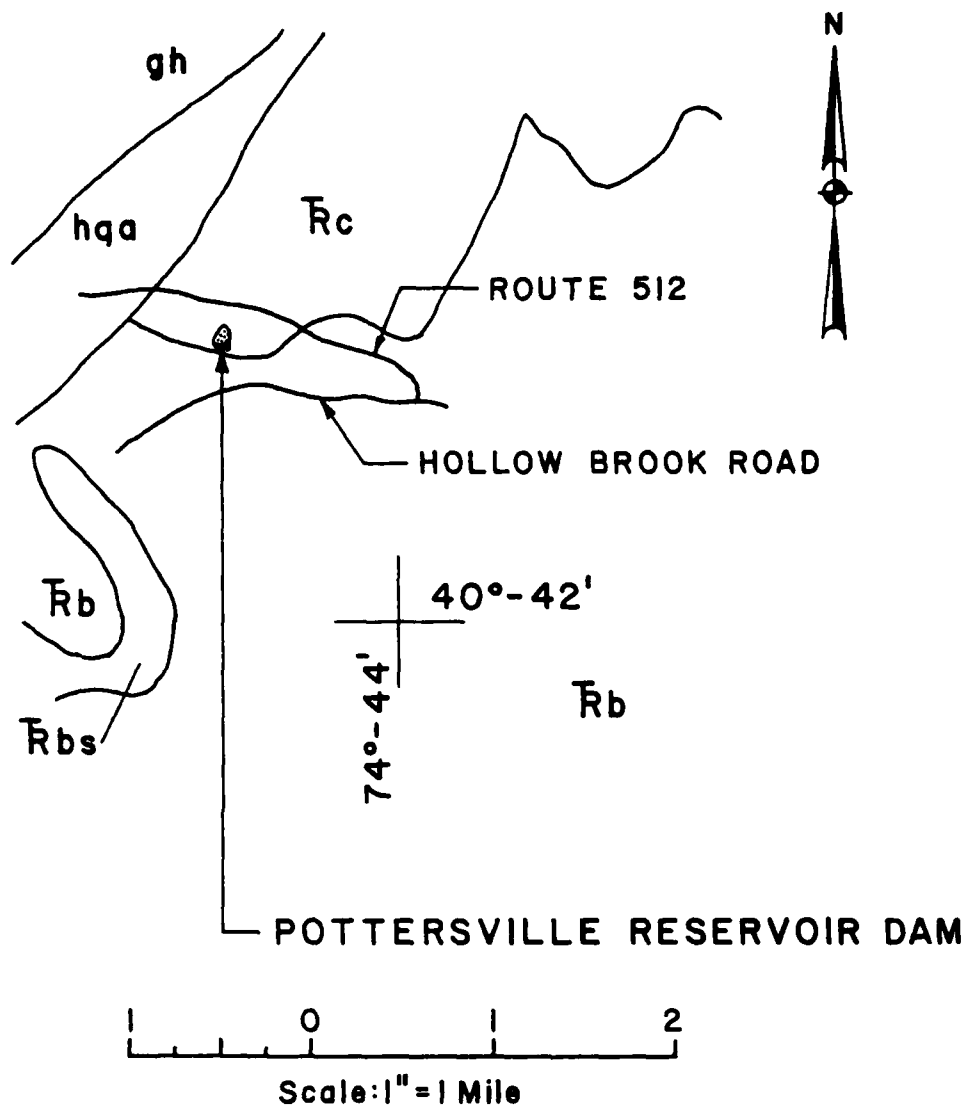


KEY MAP

PLATE I



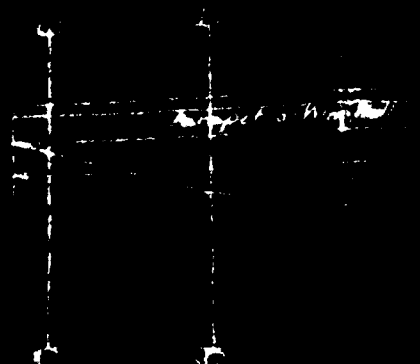
VICINITY MAP



LEGEND

- | | |
|-----------------|------------------------------------|
| | TRIASSIC |
| T _b | Brunswick Formation |
| T _c | Border Conglomerate |
| T _{bs} | Basalt Flows |
| | PRECAMBRIAN |
| gh | Hornblende Granite & Gneiss |
| hqa | Hypersthene-Quartz-Andesine Gneiss |

GEOLOGIC MAP POTTERSVILLE DAM



19. 10. 1942

1942

1942

1942

Filed Dec 10 1942. 1942

1942

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION
MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam Pottersville Reservoir Dam County Hunterdon State New Jersey Coordinators NJ-DEP

Date(s) Inspection January 9, 1981 Weather Cloudy Temperature 15°F
February 3, 1981 Cloudy 40°F

Pool Elevation at Time of Inspection 482.5 NGVD Tailwater at Time of Inspection 465 NGVD

Inspection Personnel:

January 9, 1981

February 3, 1981

William Birch

Thomas Moroney

Thomas Moroney

Joseph Sirianni (Recorder)

OWNER/REPRESENTATIVE:

None attended

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	REMARKS AND RECOMMENDATIONS
<p>SEEPAGE OR LEAKAGE</p> <p>Seepage was noticed along almost the entire downstream face of the spillway and at a point approximately half way up the dam just to the right of the spillway.</p>	<p>Monitor seepage for clearness and quantity.</p>
<p>STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS</p> <p>Good condition.</p>	
<p>DRAINS</p> <p>None</p>	
<p>WATER PASSAGES</p> <p>See outlet works.</p>	
<p>FOUNDATIONS</p> <p>Unknown.</p>	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Minor cracking on concrete capping both sides of spillway. Concrete facing is missing on upstream side of left and right wingwalls. The mortar is missing from joints on the spillway side of the left wingwall. Vegetation is growing from cracks in the joints on both the upstream and downstream faces of the wingwalls and across the crest of the spillway.	Repair cracks and replace missing facing with epoxy concrete. Remove vegetation from joints and repoint.
STRUCTURAL CRACKING	The masonry facing on the downstream side of the left wingwall half way between the end of the dam and the spillway has sloughed exposing the stone center.	Repair and replace the masonry facing.
VERTICAL & HORIZONTAL ALIGNMENT	Both horizontal and vertical alignments are good.	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	The stilling basin for the outlet works is the natural downstream channel.	
INTAKE STRUCTURE	Two-8-inch cast iron valves attached to a concrete structure on the upstream side of the left wingwall flow into a 8-inch C.I. pipe that feeds the chlorination building. Also a 16-inch C.I. pipe controlled by a valve is the low-level outlet. All three valves are controlled by key operated stems.	
OUTLET STRUCTURE	The 16-inch C.I. pipe discharges through the left portion of the spillway directly into the downstream channel. There is another 16-inch C.I. pipe through the right part of the spillway, controls for this pipe were not found. Operation of 16-inch valve on the left was not demonstrated.	Determine if 16-inch valve is operable, and if not institute remedial actions to make operable.
OUTLET FACILITIES	None.	
EMERGENCY GATE	None.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR	Some vegetation is growing between the mortared joints on the crest of the spillway.	Remove vegetation and repoint joints.
APPROACH CHANNEL	Reservoir is approach channel.	
DISCHARGE CHANNEL	Spillway discharges into the natural stream channel.	
BRIDGE AND PIERS	None	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS		
None.		
OBSERVATION WELLS		
None.		
WEIRS		
None.		
PIEZOMETERS		
None.		
OTHER		
None.		

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	Reservoir slopes are moderately steep and heavily wooded. There is no indication of slope instability.	
SEDIMENTATION	None observed.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Channel is narrow with rocky bottom and in good condition.	
SLOPES	Slopes are moderately steep and heavily wooded.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Water Company chlorination building is on left bank of channel just downstream of dam. Channel passes under timber bridge for access road to site 270 feet downstream. Approximately 1 mile downstream is a new housing development.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available on microfilm at NJ Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08625
REGIONAL VICINITY MAP	Available - Hunterdon County Map and U.S.G.S. Quadrangle Sheet for Califon, NJ
CONSTRUCTION HISTORY	History can be deduced from microfilm at NJ-DEP.
TYPICAL SECTIONS OF DAM	Available on microfilm at NJ-DEP.
HYDROLOGIC/HYDRAULIC DATA	Not available.
OUTLETS - PLAN	Available on microfilm at NJ-DEP.
- DETAILS	Not available
- CONSTRAINTS	None
- DISCHARGE RATINGS	Not available.
RAINFALL / RESERVOIR RECORDS	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	Design memorandum available on microfilm at NJ-DEP.
GEOLOGY REPORTS	Available NJ-DEP, Geologic Overlay Sheet No. 25 and Engineering Soil Survey of New Jersey, Report No. 6- Hunterdon County, by Rutgers University (New Brunswick, NJ).
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Unknown.
SPILLWAY PLAN - SECTIONS - DETAILS	Available on microfilm at NJ-DEP.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None available.
MODIFICATIONS	None available.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Available on microfilm at NJ-DEP.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	None known to exist.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS



Photo 1 - View of dam from the left end. Two valve stems by wood plank control the flow to the chlorination building. The valve stem just to the right of the dam is for the low-level outlet. (Photo taken February 3, 1981).



Photo 2 - View of spillway. Note vegetation growing between joints. (Photo taken February 3, 1981).

POTTERSVILLE RESERVOIR DAM



Photo 3 - View of upstream face of right section of dam showing missing concrete facing. (Photo taken January 9, 1981).



Photo 4 - View of downstream face of left section of dam showing deteriorated rock facing. (Photo taken February 3, 1981).



Photo 5 - View of downstream face of spillway and right section of dam. Seepage in right section is shown by ice on face. Pipes in face of spillway are low-level outlets. (Photo taken February 3, 1981).



Photo 6 - View of reservoir taken from top of dam. (Photo taken January 9, 1981).

POTTERSVILLE RESERVOIR DAM



Photo 7 - View of downstream channel from top of dam.
Chlorination building is to the left.
(Photo taken January 9, 1981).

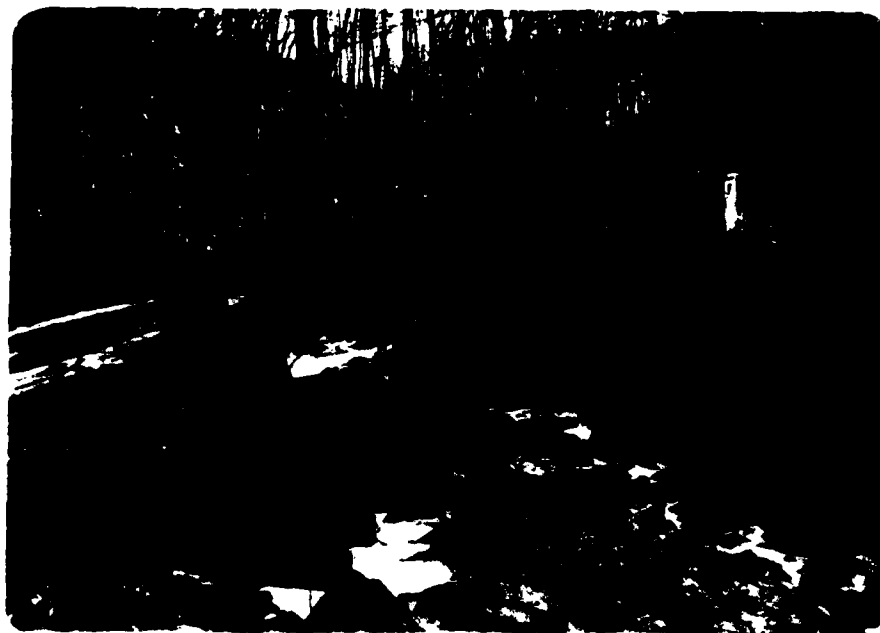


Photo 8 - View of timber bridge across access road.
Concrete building on the right is a gaging
station. (Photo taken on February 3, 1981).

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: POTTERSVILLE RESERVOIR DAM

Drainage Area Characteristics: 2.0 square miles

Elevation Top Normal Pool (Storage Capacity): 482.5 NGVD (15 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 488.83 NGVD (SDF pool: 35 acre-feet)

Elevation Top Dam: 485.5 NGVD (23 acre-feet)

SPILLWAY CREST:

a. Elevation 482.5 NGVD

b. Type Broad crested; notched weir

c. Width 3 feet

d. Length Notch: 20 feet Total 50 feet

e. Location Spillover Entire length

f. No. and Type of Gates None

OUTLET WORKS:

a. Type 2 - 16-inch C.I.P.

b. Location Left side normal spillway and right side storm spillway.

c. Entrance Inverts Unknown

d. Exit Inverts 471 NGVD estimated

e. Emergency Draindown Facilities Gate valve - 16-inch C.I.P.

HYDROMETEOROLOGICAL GAGES:

a. Type None

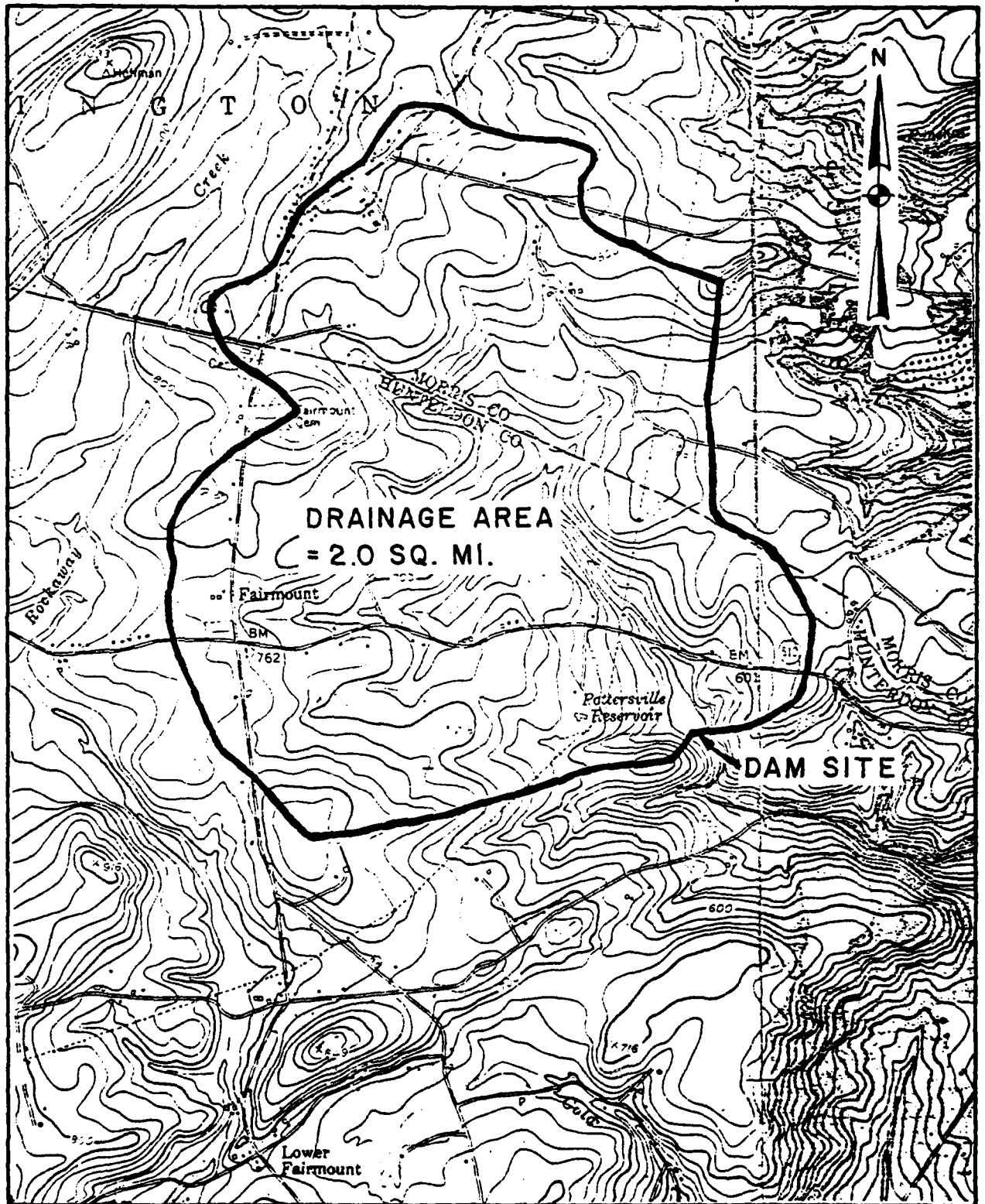
b. Location None

c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: 722 cfs at elevation 485.5 NGVD

APPENDIX D

HYDROLOGIC COMPUTATIONS



2,000 0 2,000 4,000

Scale: 1" = 2,000 FT.

POTTERSVILLE DAM DRAINAGE BASIN

Area of Lake at normal pool level = 2.5 Ac
Height of the Dam = 23' Max.

Small Dam. Significant Hazard.

S.D.F. : $\frac{1}{2}$ PMF

Hydrologic Analysis

D.A. = 2.0 sq miles

Inflow hydrograph at reservoir was determined using HEC 1 DB program. Inflow routed through reservoir.

Reservoir Stage Area Relations.

Elevation

Area in Acres

464.7

0

482.5

2.5 Ac.

500

6.88 Ac (Measured from U.S.G.S quad)

Reservoir storage stage relationship was determined by HEC 1 DB program from the Area-stage relationship.

Determination of PMP

Probable maximum ppt. (inches) for an
area 10 square miles and 6 hour duration
= 26"

D.A = 2.0 sq miles.

The adjustment of PMP is due to the
drainage area and unlikelihood of a
perfect strike of a storm center on
any particular small basin.

Depth area duration relationship.

Percentage to be applied to the above 6 hr
PMP :-

6 hr = 100%
12 hr = 108%
24 hr = 117%

Initial Infiltration = 1"
Constant infiltration = 0.1"/hr.

Determination of Tc

- 1) Estimating Tc from velocity estimate and watercourse length

	Slope	Vel.	Remarks
Overland flow	$\frac{930-600}{5900} = 5.6\%$	3 ft/sec	Pastures (upper portion of watershed)
Reach 1	$\frac{600-485}{4000} = 2.8\%$	1 ft/sec	Natural channel (Neglect flow thro' Lake)
$T_c = \frac{5900}{3 \times 3600} + \frac{4000}{1 \times 3600}$ $= 1.65 \text{ hrs.}$			

- 2) Estimating Tc assuming same vel.

$$\frac{9900}{2 \times 3600} = 1.38 \text{ hrs}$$

- 3) From Nomograph of Design of Small Dam (S.C.S Guide) → Same as Kirpich

$$T_c = \left(\frac{11.9 L^3}{H} \right)^{.385}$$

L in miles = 1.875 miles
H in ft = 445 ft

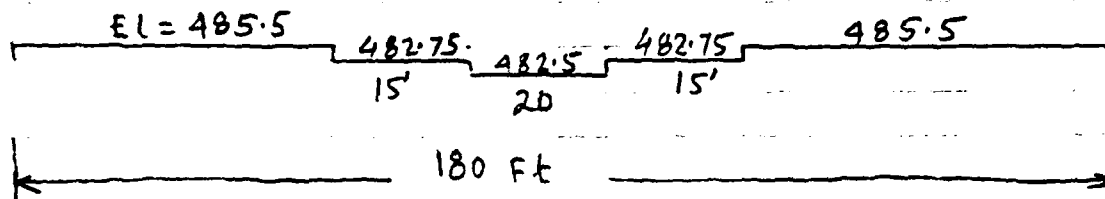
$$= \left[\frac{11.9 \times (1.875)^3}{445} \right]^{.385}$$

$$= .512 \text{ Hrs.}$$

Use Tc = 1.2 hrs

Lag = $0.6 \times 1.2 = .72 \text{ hrs.}$

Schematic Layout of Dam



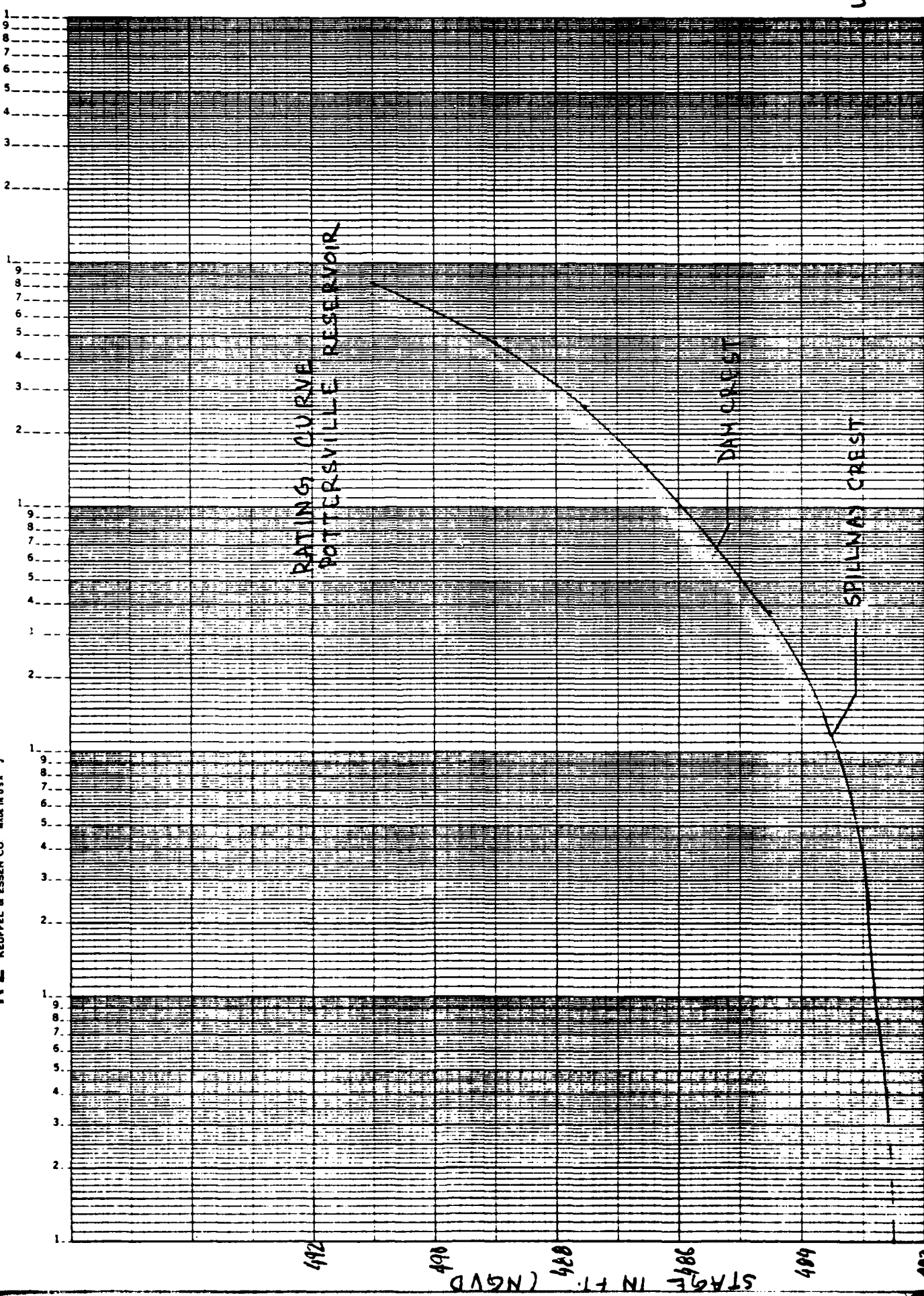
Center of Spillway $Q_1 = CL H_1^{3/2} = 3.0 \times 20 H_1^{3/2} = 60 H_1^{3/2}$
 Left and Right of Spillway $Q_2 = CL H_2^{3/2} = 3.0 \times 30 H_2^{3/2} = 90 H_2^{3/2}$
 Dam $Q_3 = CL H_3^{3/2} = 2.7 \times 130 H_3^{3/2} = 351 H_3^{3/2}$

$$Q = 60 H_1^{3/2} + 90 H_2^{3/2} + 350 H_3^{3/2}$$

N.S.EI	H_1	$Q_1 = 60 H_1^{3/2}$	H_2	$Q_2 = 90 H_2^{3/2}$	H_3	$Q_3 = 350 H_3^{3/2}$	$Q = (2) + (5) + (7)$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
482.5	0	0	-	-	-	-	0
482.75	.25	7.5	0	-	-	-	8
483.5	1	60	.75	58	-	-	118
484.5	2	170	1.75	208	-	-	378
485.5	3	312	2.75	410	0	-	722
486.5	4	480	3.75	654	1	350	1484
487.5	5	671	4.75	932	2	990	2593
489	6.5	994	6.25	1406	3.5	2292	4692
491	8.5	1487	8.25	2433	5.5	4515	8135

K-E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6210

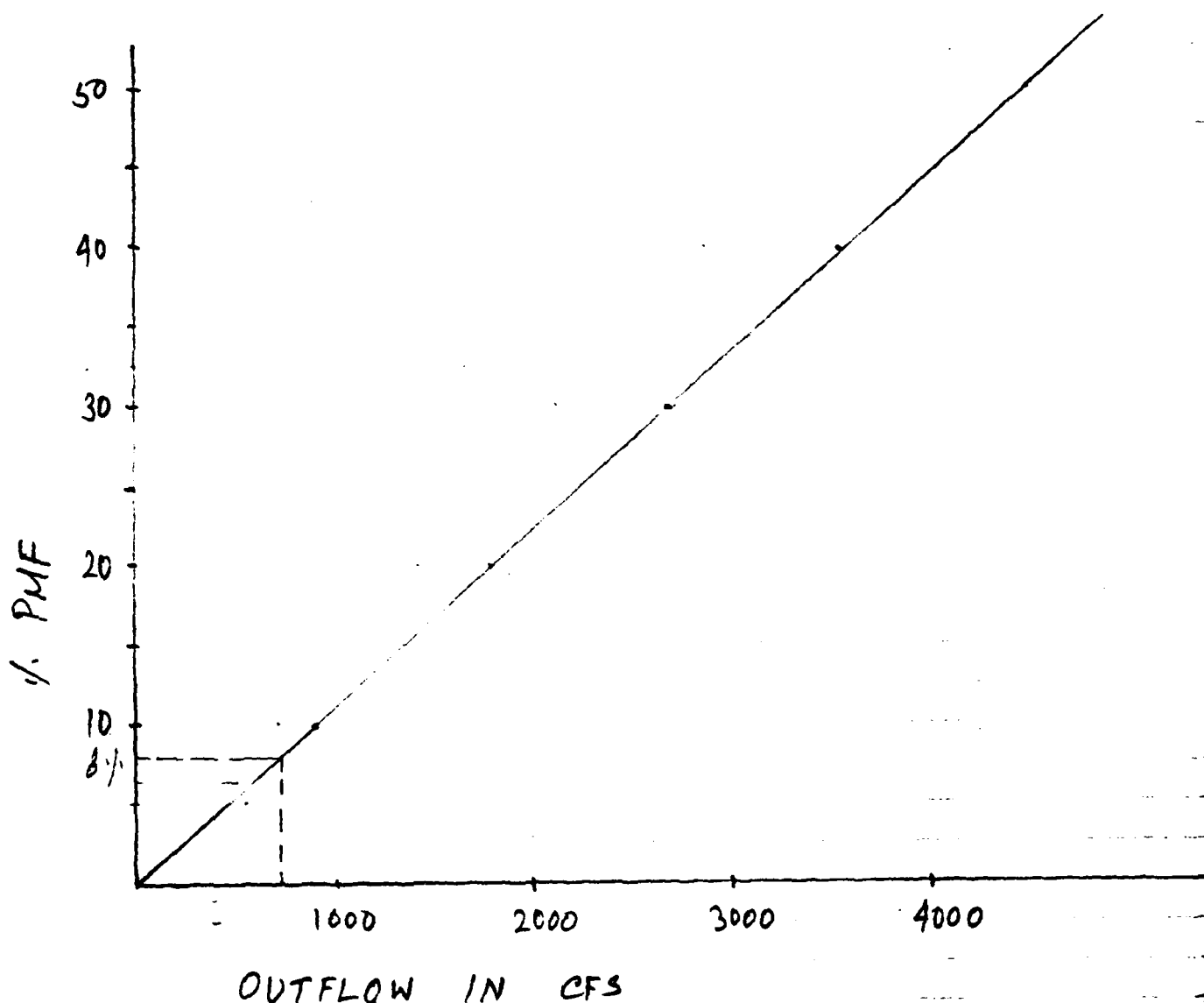


PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Pottersville Res. Dam
COMPUTED BY S.B. CHECKED BY _____

SHEET NO. 6 OF _____
JOB NO. 10-176-01
DATE March 1981

Overtopping Potential



Overtopping of Dam occurs at 722 cfs at an
El = 485.5

$Q = 722$ (8 % PMF)

DRAWDOWN COMPUTATION:

16" ϕ low level outlet $A = 1.4 \text{ sq. ft}$
 $R = 1.33$

Length of pipe $\approx 35 \text{ ft}$

Friction loss through the pipe

$$h_f = \frac{n^2 L \cdot 2g}{2.2 \cdot 2^{4/3}} \cdot \frac{V^2}{2g}$$

$$= \frac{(0.013)^2 \times 35 \times 64.4}{2.2 \times (1.33)^{4/3}} \cdot \frac{V^2}{2g}$$

$n = 0.013$ for C.I. pipe

$$= 0.76 \frac{V^2}{2g}$$

$$h_{entrance} = 1.2 \frac{V^2}{2g}$$

$$h_{exit} = 1 \frac{V^2}{2g}$$

$$h_L = 2 \frac{V^2}{2g}$$

$$V^2 = \frac{1}{2} \times 2gh$$

$$V = 0.707 \sqrt{2gh}$$

$C_d \approx 0.707$ by mannings ~~to~~ seems to be a little high ; Use orifice equation

$$C_d' = 0.63$$

$$Q = 0.63 \sqrt{2gh} \cdot A = 7 \sqrt{A}$$

Normal elevation to start = 482.5

$$\text{Inflow} = 2 \text{ cfs/mi}^2 \times 2 = 4 \text{ cfs}$$

Assume Tailwater depth = 465 (Use 471.7 = CL of mb)

$$A_2 = \left(\frac{h_2}{h_1} \right)^2 A_1 = \left(\frac{h_2}{17.5} \right)^2 \times 25 = 0.0816 h_2^2$$

$A_1 = 2.5 A_c$
 $h_1 = 17.5$

$$\text{Drawdown Time} = \frac{\text{Vol in AF} \times 93570}{Q \times 3600} = \frac{\text{Vol} \times 12.1}{Q}$$

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Pettersonville Res. Dam
COMPUTED BY S.B. CHECKED BY _____

SHEET NO. 8 OF _____
JOB NO. 10-1176-01
DATE March, 1981

Res EL	Area	Av. Area	Vol	h (AV)	Q TVA	Drawdown $\frac{Vol \times 12.1}{Q}$	Cum Time	Drawdown with inflow $\frac{4 \times t}{2}$	Cum line
	Ac	Ac	AF	FA	CFS	HRS	HRS		HRS
482.5	2.5				✓				
		2.23	4.46	9.8	21.9	2.46	2.46	.45	2.91
480.5	1.96								
		1.73	3.46	7.8	19.5	2.14	4.60	.44	5.49
478.5	1.49								
		1.29	2.58	5.8	16.9	1.85	6.45	.44	7.78
476.5	1.08								
		.91	1.82	3.8	13.6	1.62	8.07	.48	9.88
474.5	.74								
		.60	1.20	1.8	9.4	1.54	9.61	.65	12.07
472.5	.46								
		.41	.33	.4	4.4	.91	10.52	.83	13.81
471.7	.37								

Time of Drawdown without inflow ≈ 10.5 hrs

Time of Drawdown with const inflow ≈ 13.8 hrs

 FLOOD HYDROGRAPH FALCON (HLL-1)
 FOR SAFETY VERIFICATION JULY 1978
 LAST MODIFICATION 16 FEB 79

RUN DATE: THU, MAR 05 1981
 TIME: 14:48:06

N.J. DAM INSPECTION
 POTTERSVILLE RESERVOIR DAM
 MULTICRATER POND HOODING

FOR SPECIFICATION

NO	NR	NRIN	IRAY	IRH	IRIN	REIR	IRPL	IRPL	NRIN
100	0	15	0	0	0	0	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED

PLAN= 1 NRTO= 5 LATID= 1

RLQOS= 0.20 2.40 0.30 0.20 0.10

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW	TIME	IRAY	IRH	IRIN	REIR	IRPL	IRPL	NRIN	NRIN
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0

HYDROGRAPH DATA

TIME	IRAY	IRH	IRIN	REIR	IRPL	IRPL	NRIN	NRIN
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0

PRECIP DATA

TIME	IRAY	IRH	IRIN	REIR	IRPL	IRPL	NRIN	NRIN
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0

INSPE COMPUTED BY THE FSD-3000 IS 0.000

TIME DATA

TIME	IRAY	IRH	IRIN	REIR	IRPL	IRPL	NRIN	NRIN
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0

UNIT HYDROGRAPH DATA

TIME	IRAY	IRH	IRIN	REIR	IRPL	IRPL	NRIN	NRIN
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0

REGRESSION DATA

TIME	IRAY	IRH	IRIN	REIR	IRPL	IRPL	NRIN	NRIN
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0

UNIT HYDROGRAPH 16 END OF FLOOD ORIGINATES, IC= 0.00 HOURS, LAG= 0.72 VOL= 1.00

114. 735. 1121. 1073. 800. 405. 290. 1129. 1111. 48.

Q	HR	PERIOD	RAIN	EACS	LOSS	COMP D	END-OF-PERIOD FLOW	EXC	LOSS	COMP Q
1.01	0.15	1	0.00	0.00	0.00	2.	1.02	97	0.00	0.02
1.01	0.30	2	0.00	0.00	0.00	2.	1.02	98	0.00	0.02
1.01	0.45	3	0.00	0.00	0.00	2.	1.02	99	0.00	0.02
1.01	1.00	4	0.00	0.00	0.00	2.	1.02	100	0.00	0.02
1.01	1.15	5	0.00	0.00	0.00	2.	0.00	101	0.00	0.02
1.01	1.30	6	0.00	0.00	0.00	2.	0.00	102	0.00	0.02
1.01	1.45	7	0.00	0.00	0.00	1.	0.00	103	0.00	0.02
1.01	2.00	8	0.00	0.00	0.00	1.	0.00	104	0.00	0.02
1.01	2.15	9	0.00	0.00	0.00	1.	0.00	105	0.00	0.02
1.01	2.30	10	0.00	0.00	0.00	1.	0.00	106	0.00	0.02
1.01	2.45	11	0.00	0.00	0.00	1.	0.00	107	0.00	0.02
1.01	3.00	12	0.00	0.00	0.00	1.	0.00	108	0.00	0.02
1.01	3.15	13	0.00	0.00	0.00	1.	0.00	109	0.00	0.02
1.01	3.30	14	0.00	0.00	0.00	1.	0.00	110	0.00	0.02
1.01	3.45	15	0.00	0.00	0.00	1.	0.00	111	0.00	0.02
1.01	4.00	16	0.00	0.00	0.00	1.	0.00	112	0.00	0.02
1.01	4.15	17	0.00	0.00	0.00	1.	0.00	113	0.00	0.02
1.01	4.30	18	0.00	0.00	0.00	1.	0.00	114	0.00	0.02
1.01	4.45	19	0.00	0.00	0.00	1.	0.00	115	0.00	0.02
1.01	5.00	20	0.00	0.00	0.00	1.	0.00	116	0.00	0.02
1.01	5.15	21	0.00	0.00	0.00	1.	0.00	117	0.00	0.02
1.01	5.30	22	0.00	0.00	0.00	1.	0.00	118	0.00	0.02
1.01	5.45	23	0.00	0.00	0.00	1.	0.00	119	0.00	0.02
1.01	6.00	24	0.00	0.00	0.00	1.	0.00	120	0.00	0.02
1.01	6.15	25	0.00	0.00	0.00	1.	0.00	121	0.00	0.02
1.01	6.30	26	0.00	0.00	0.00	1.	0.00	122	0.00	0.02
1.01	6.45	27	0.00	0.00	0.00	1.	0.00	123	0.00	0.02
1.01	7.00	28	0.00	0.00	0.00	1.	0.00	124	0.00	0.02
1.01	7.15	29	0.00	0.00	0.00	1.	0.00	125	0.00	0.02
1.01	7.30	30	0.00	0.00	0.00	1.	0.00	126	0.00	0.02
1.01	7.45	31	0.00	0.00	0.00	1.	0.00	127	0.00	0.02
1.01	8.00	32	0.00	0.00	0.00	1.	0.00	128	0.00	0.02
1.01	8.15	33	0.00	0.00	0.00	1.	0.00	129	0.00	0.02
1.01	8.30	34	0.00	0.00	0.00	1.	0.00	130	0.00	0.02
1.01	8.45	35	0.00	0.00	0.00	1.	0.00	131	0.00	0.02
1.01	9.00	36	0.00	0.00	0.00	1.	0.00	132	0.00	0.02
1.01	9.15	37	0.00	0.00	0.00	1.	0.00	133	0.00	0.02
1.01	9.30	38	0.00	0.00	0.00	1.	0.00	134	0.00	0.02
1.01	9.45	39	0.00	0.00	0.00	1.	0.00	135	0.00	0.02

PLAN FLOOD AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN RATIO FLOODING CONDITIONS
FLOODS IN CUBIC FEET PER SECOND (CFS) BEHIND DICES (PER SECOND)
AREA IN SQUARE FEET (SQUARE FEET)

OPERATION STATION AREA PLAN RATIO 1 RATIO 2 RATIO 3 RATIO 4 RATIO 5
HYDROGRAPH AT RES (2.00 1 3609. 2887. 2166. 1444. 222. 222.
(5.18) (102.20) (81.76) (61.32) (40.88) (20.44)

ROUTED TO DAM (5.00 1 3559. 2861. 2131. 1422. 719. 719.
(5.18) (100.79) (91.03) (60.36) (40.27) (20.37)

ROUTED TO EACH 1 (2.00 1 3554. 2868. 2151. 1440. 725. 725.
(5.18) (100.64) (91.21) (60.91) (40.77) (20.57)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 INITIAL VALUE 482.50 SPILLWAY CREST TOP OF DAM 485.50

ELEVATION
STORAGE
OUTFLOW

15. 15. 33.
10. 0. 588.

RATIO OF FPM	MAXIMUM RESERVOIR W. S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	489.49	2.99	33.	3559.	5.75	40.25	0.00
0.40	487.95	2.45	31.	2861.	5.50	40.25	0.00
0.30	487.35	1.85	29.	2131.	4.75	40.50	0.00
0.20	485.65	1.15	27.	1422.	2.50	40.50	0.00
0.10	485.70	0.20	24.	719.	0.75	40.50	0.00